SARS Epidemiology

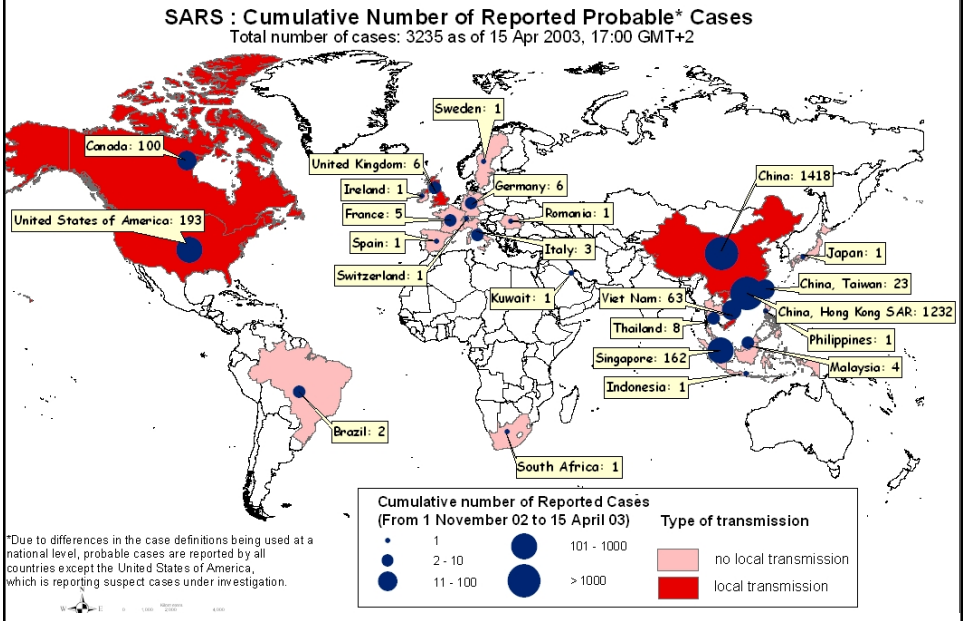
The WHO SARS Team

30 May 2003 = day x+76

GLOBAL HEALTH SECURITY

WHO SARS Emergency Response

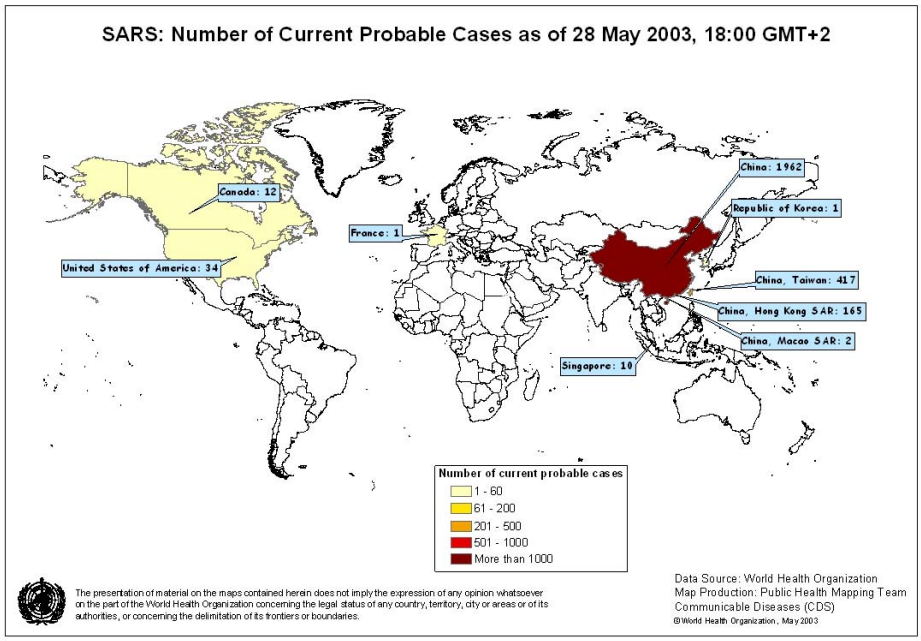
KS 23/3/3



GLOBAL HEALTH SECURITY

WHO SARS Coordination and Response

KS 27/05/03



Epidemiology→ Today

- Epidemiological parameters
  - Risk groups, case-fatality ratio; age groups; incubation period
- Routes and patterns of transmission/infection
- Virus excretion (duration/amount/pattern)
- Asymptomatic, silent and chronic infection
- Discrepancies between clinical and laboratory findings
- Seasonal variability
- Animals as source of infection and/or reservoirs
- Origin and begin of outbreak
- Virus stability/tenacity in the environment
- Spectrum of illness
- Ab-kinetics; duration of immunity
- Superspreaders
- Co-infection, relapses
- Effectiveness of interventions

What will not be covered:

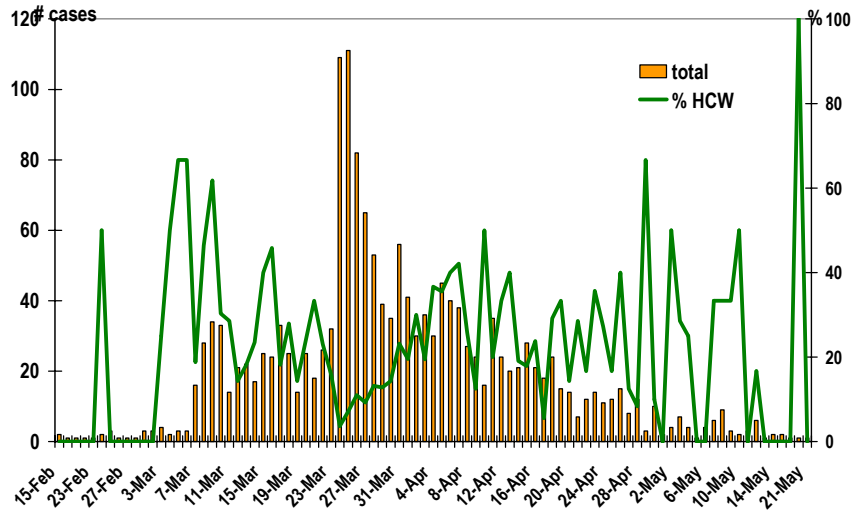
- Key developments in outbreak history and evolution
- Economical and health impact
- Emergence of SARS and Global Alert
- Travel recommendations
- Interventions and their effectiveness
- International collaboration and partners
- What we still need to know
- What we are learning
- Real and perceived risks
- …..
- ……

Outbreak began in 2002

- Serosurveys blood donors
  - Hong Kong
    - ~340 sera prior to SARS (blood donors)→ all neg.
    - 200 sera (blood donors) during April 2003 → all neg
  - USA, CDC
    - 400 sera prior to SARS—> all neg.

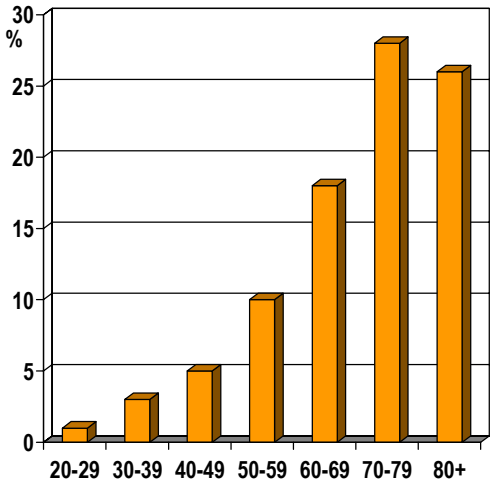
- Virus isolation/detection
  - Canada: 365 NPS from pre-SARS patients→ all PCR neg.
- Epidemiology
  - No temporal/spatial clustering of 800 atypical pneumonia cases in Guandong between 1999 and 2002

SARS Hong Kong: occupational risks:
affected HCW



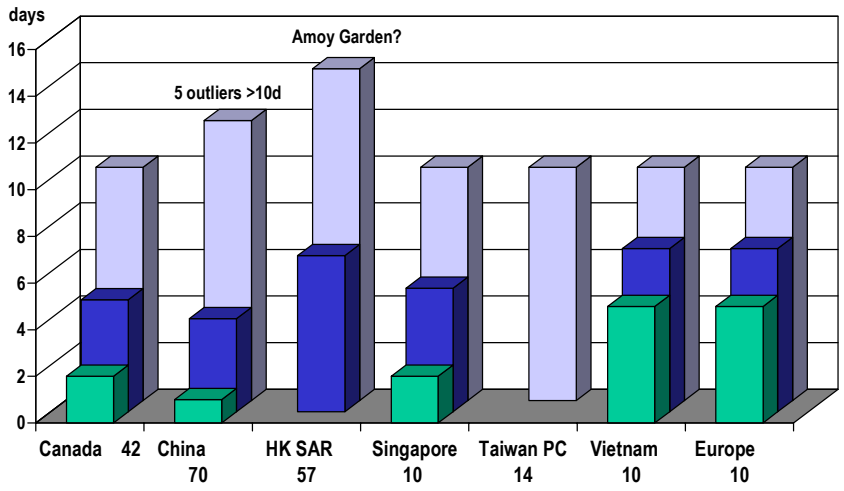
SARS Case-fatality rate: ~15%

- Age specific CFR China →
- CFR in individuals over 60
  - China: 72%
  - Canada: 83%
  - Hong Kong: >50%
- RF: age, male sex (HK), co-morbidity
- Influence of health care system unclear



Reported at WHO SARS Epi Consultation 16 May 2003

SARS Incubation period



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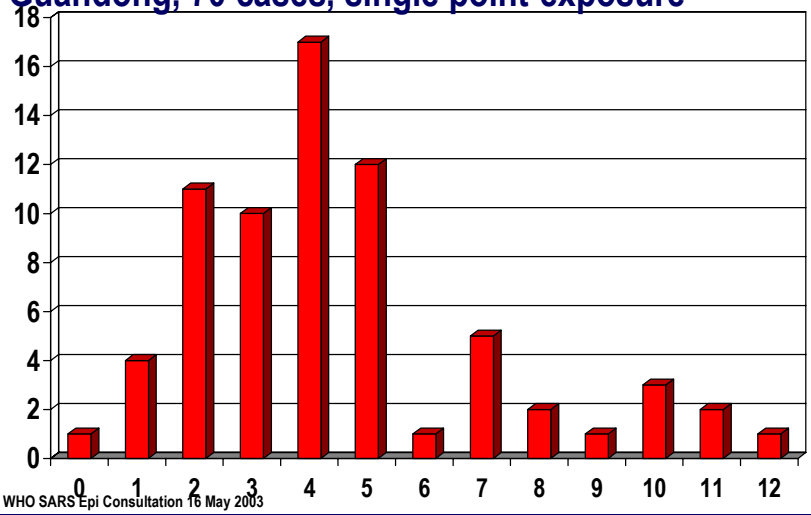
SARS incubation period

- Guandong, 70 cases, single point-exposure



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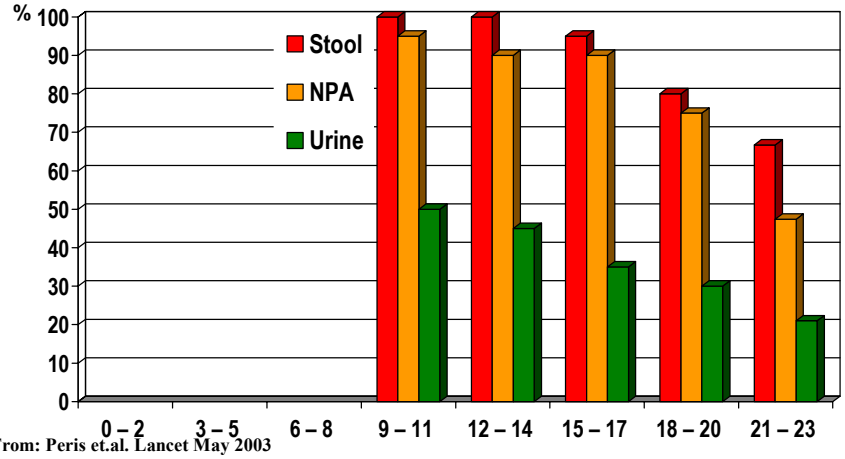
SARS Incubation period

- Detailed investigation of outliers is needed before public health policy is changed
  - Combination of 200 cases from 7 sites into international standardized dataset necessary to refining current IKP estimates
- Current data
  - 2-10 days; medium 5 days
  - Based on single point exposure cases or well-defined exposure interval from 7 sites
  - Do not allow to assess whether route of infection influences incubation period

SARS virus excretion patterns

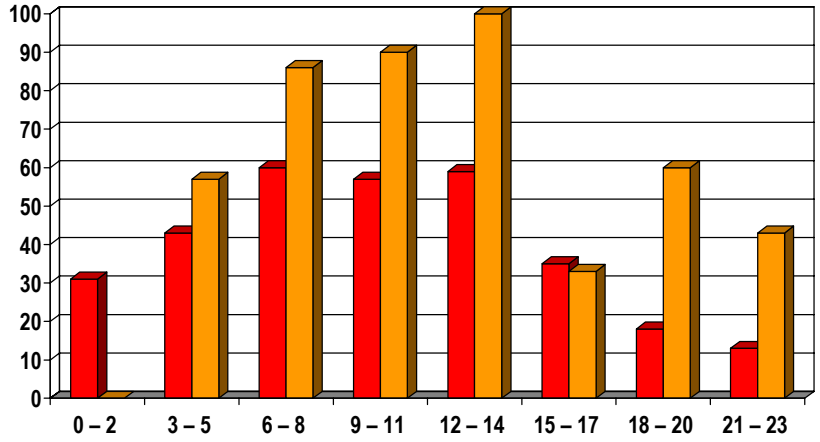
- Sequential sampling 20 patients with initial NPA RT-PCR + and sero-conversion



From: Peris et.al. Lancet May 2003

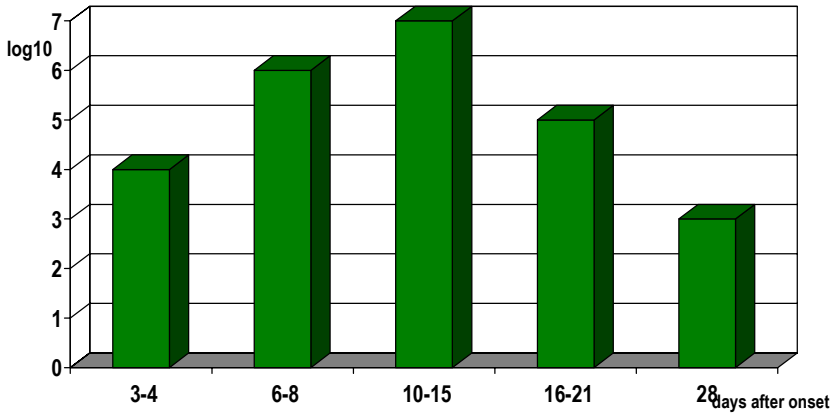
SARS virus excretion patterns

- 392 NPA/TNS; 50 stool samples, HK SAR



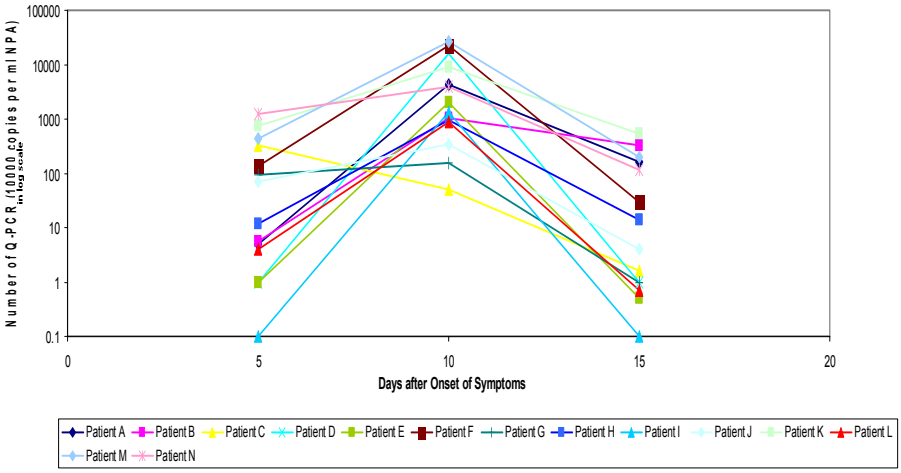
SARS virus excretion Amoy Garden

- RT-PCR (Artus), 34 stool samples; different patients



Sequential quantitative RT-PCR levels

NPA 14 SARS patients



From: Peris et.al. Lancet May 2003

SARS Virus/RNA excretion

- Respiratory specimen
  - Pasteur Inst Paris; one case: +32 days virus RNA detectable; Virus isolation failed
- Stool PCR pos
  - Germany/Singapore: >42 days
  - Hong Kong (Virus Unit): >49 days
- Conjunctiva
  - Germany/Singapore: PCR pos day 1
- Virus isolation up to day 16

SARS transmission pattern

- No evidence of transmission before onset of first symptoms
- A few cases thought to have transmitted in the early prodromal period (small # of source cases, Canada)
- Those who are very ill or experiencing rapid clinical deterioration, usually during second week of illness, are the most communicable
- No evidence of transmission 10 days post-fever resolution

SARS Routes of transmission

- Primary mode
  - Direct mucous membrane contact with infectious respiratory droplets
- Events that promote aerosolisation of infectious ex/secretions/body fluids in hospitals or other settings, may amplify transmission
- Role of fecal-oral transmission remains unknown
- Contamination of materials and objects with ex/secretions and body fluids may play role in certain circumstances
  - Health care settings, closed environments
- No reports on food or water borne transmission

SARS Routes of transmission

- Cases occurred primarily in those in close contact with very ill in health care settings and households
- Transmission to casual and social contacts has occasionally occurred
  - when there has been sustained, close contact with a case of SARS (in workplaces, airplanes or taxis) or in high-risk transmission settings, such as health care settings and households.
- No reports of transmission
  - to and between children
  - Vertical - blood

SARS transmission on airplanes

- No documented airplane transmission after 23 March

- Facts
  - 41 flights with probable cases
  - 4 flights with total of 25 secondary cases
    - SQ25 New York–Frankfurt, 14 March 2003→ **3**
    - CA112 Hong Kong–Beijing, 15 March 2003→**18**
    - TG614 Bangkok–Beijing, 23 March 2003→ **1**
    - AF171 Hanoi– Bangkok– Paris, 22/23 March 2003→ **3**

Asymptomatic excretors

- Spectrum of disease still incompletely understood
- Hong Kong: Amoy garden during quarantine (HK Virus Unit)
  - One individual: seroconversion; virus isolation; PCR pos
  - 316 persons: 32 PCR pos in TNS (some positive up to 10 days)
    - Serolog data pending, Sampling time unknown; mild disease? (ILI; diarrhea)
  - 162 sera (2 April)
    - 1 Ab positive (IFA)→ also positive by PCR in throat swab
- Canada
  - Two individuals without any links to SARS patients or history of disease: virus isolation from stool
- No reports on transmission from asymptomatic individuals

Sero-conversion without disease

- Healthy HCW seroconverted
  - Hong Kong: 3 out of 500 HCW (Prince Wales H) pos by IFA
    - Two with fever episode
  - China: some …
- Guandong: 5 out of 10 wild animal traders from one live animal marked seroconverted (IFA)

Virus/RNA excretion without seroconversion

- Hong Kong Virus Unit
  - Several (3-4) individuals PCR pos without seroconversion (day 32)

Virus stability

- Virus survives
  - stool and urine for at least 2 days
  - diarrhoeal stool up to 4 days
  - dried at room temperature at least 2 days
  - Acetone fixed slides
  - At -4 ºC and -80 ºC at least 21 days with minimal reduction
- Does Not survive
  - Usually used disinfectant
  - Temp 56 ºC for 30 min in blood serum
  - fixed In infected cells after -20 ºC Acetone fixation

SARS Animal testing Summary

- Trials
  - Pigs and turkey: challenge (Canada)
  - Rabbits, guinea pigs, mice: serum prod (Canada)
  - Japanese quail, chicken, ducks (ongoing) (Georgia, USA)
  - Non-human primates (Rotterdam; USAMRID; China)→ only animal models
  - Rodents (mice; rats): France; China
- Environment
  - Amoy garden
    - Cats: 2 of 4 seroconverted; one PCR throat pos
    - Dog: PCR-pos in feces (quantity unknown)
    - Cockroaches: droppings and intestinal content pos; no isolation from tissue
    - Rat: droppings pos PCR

SARS Animal reservoir?

- Shenzhen live animal market; 3 samplings; 8 species; 25 animals
- Masked Palm Civets
  - 6/6 virus isolation or PCR pos (nasal/fecal)
  - 3/4 neutralizing Ab titre
- Racoon dog
  - Virus isolation
- Chinese ferret badger
  - Neutralizing Ab titre
- 4 isolates sequenced; cross-neutralization tests

Research

- Infectious period; excretion patterns
  - Infection control; diagnostic test development
- Routes of transmission; exposure dose
- Measures on preventing transmission
- Vertical transmission; children
- Sub-clinical infection
- Animal and environmental reservoirs